amygdalina, calophylla, colossea, cordata, ficifolia, globulus, tetraptera, and several others; of other characteristic Myrtaceæ, the genera Callistemon, Syncarpia, Agonis, Melaleuca, Beaufortia, and Leptospermum; of Leguminosæ, Acacia, Gompholobium, Kennedya, Clianthus, Platylobium, &c.; of Epacrideæ, Leucopogon, Richea, Epacris, Lissanthe, and Styphelia; of Proteaceæ, Banksia, Grevillea, Xylomelum, Telopea, Hakea, Lambertia, Macadamia, Petrophila, &c.; of genera belonging to other natural orders, taking them in the order they occur in the pictures: Phyllocladus, Doryphora, Casuarina, Pimelea, Prostanthera, Billardiera, Exocarpus, Anigozanthus, Xanthorrhæa, Kingia, Cephalotus, Cheiranthera, Xanthosia, Leschenaultia, Stylidium, Johnsonia, Trichinium, Isotoma, Byblis, Actinotus, Nuytsia, Doryanthes, Fusanus, Comespermum, &c., &c. In conclusion I may state that there is a complete index to the catalogue, so that it is possible to ascertain what plants are figured by reference thereto.

W. BOTTING HEMSLEY

AN ELECTRIC RAILWAY

THE following account of the electric railway of Breuil-en-Auge is taken from an article by M. Gaston Tissandier in our contemporary, *La Nature*. The subject of electric railways, which has recently claimed public attention; and the recent construction on a commercial scale of a practical electric railway in the department of

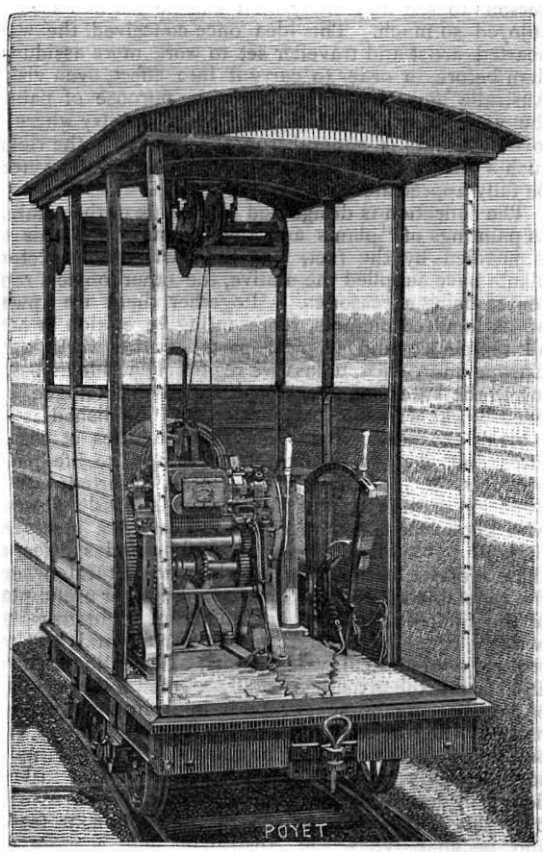

FIG. 1.—The locomotive, with dynamo-electric motor and driving-gear.

Calvados in France derives additional interest from the fact that the motive power is, in this instance, furnished by electric accumulators. We propose to give a general description of the railway, but will first briefly state the object for which the line has been constructed.

The linen-bleaching establishment of M. Paul Duchesne-Fournet is situated at Le Breuil-en-Auge, and is a large concern to which most of the linen fabrics manufactured at Lisieux are sent to be bleached. The complete process of bleaching consists in successively exposing the linen pieces first to the action of chlorine, then to alkaline baths, lastly to the sun's rays. The last operation is of course conducted out of doors by laying out the linen in the open meadows. Each length of linen measures about 100 metres, and the establishment boasts a bleaching ground of 15 hectares (37 acres). The operation of taking up the pieces is laborious, necessitating several workmen.

M. Clovis Dupuy, engineer-in-chief of the works, proposed a mechanical device for picking up the linen pieces by the aid of a railway which carried the requisite

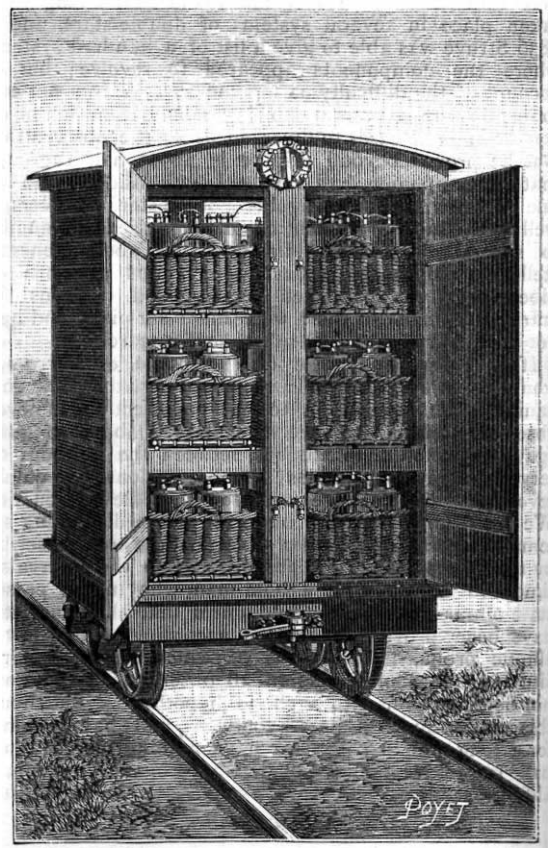

FIG. 2.—The Faure accumulators in the tender.

mechanism. But a railway worked by a steam-engine could not be tolerated in the bleaching field, as the smoke produced by the burning fuel and the ashes projected from the funnel would play havoc with the linen laid out beside the line. M. Dupuy therefore determined to build an electric railway, the construction of which is now finished, and which works very satisfactorily.

The electric railway of Le Breuil-en-Auge passes the end of each of the many plots upon which the linen is laid out, there being a piece of straight line 500 metres in length, and twenty-one branch lines. The total length is 2040 metres. The rails are of the narrow gauge of 0·8 metre (2 feet 7½ inches).

The train is driven by a locomotive shown in Fig. 1, the driving machinery being a Siemens' dynamo-electric machine working as a motor. The currents to drive the motor are supplied from a battery of Faure accumulators

contained in a separate tender, depicted in Fig. 2. The train starts from the factory with the wagons empty. Arrived at the bleach-field, it stops. By the movement of a handle, the motor is thrown into gear with a set of windlass rollers employed to wind up the linen. Passing between these rollers the linen ascends to another roller in the top of the car, which covers the machinery, where it passes to a workmen, who packs it in folds in a little

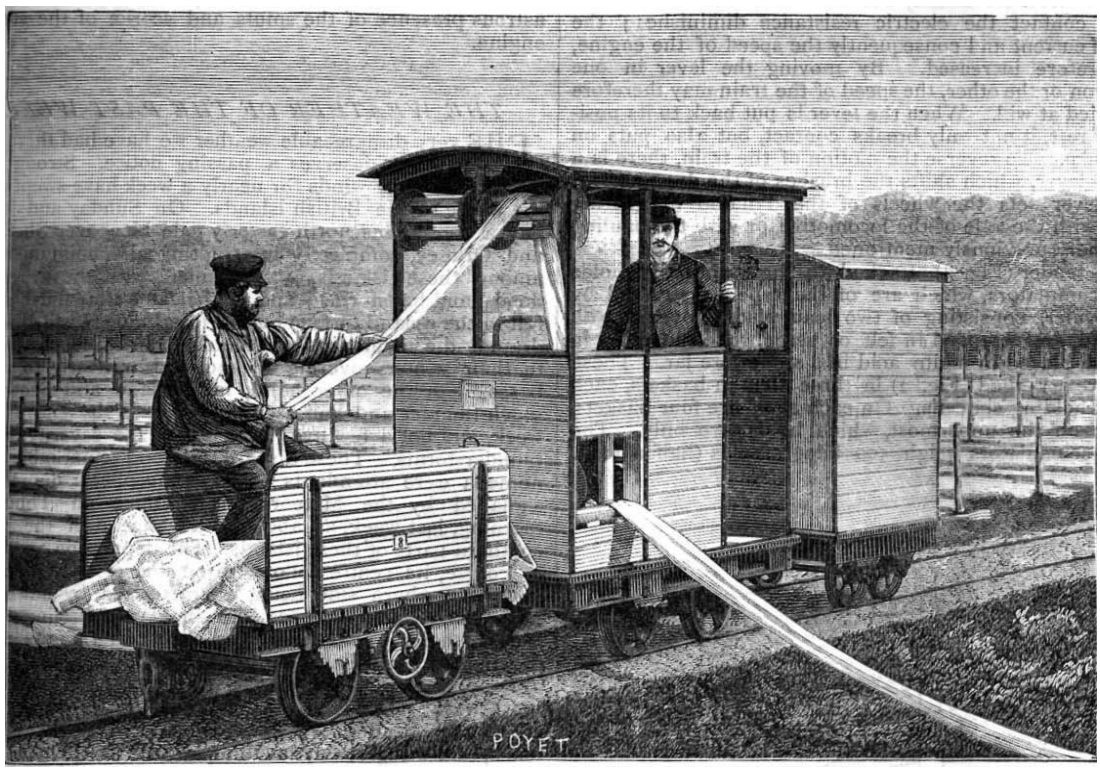

FIG. 3.—Hauling in the bleached linen.

truck (Fig. 3). Preferably all the linen pieces laid out upon the plot of neighbouring ground, are united to one another by their ends, so that a single workman can pick up 5000 metres of linen in thirty minutes, an operation usually requiring eleven hours to perform. Fig. 4 shows the train of little trucks returning loaded with 10,000 metres of linen. Having thus described the general system, it will be convenient to examine the details.

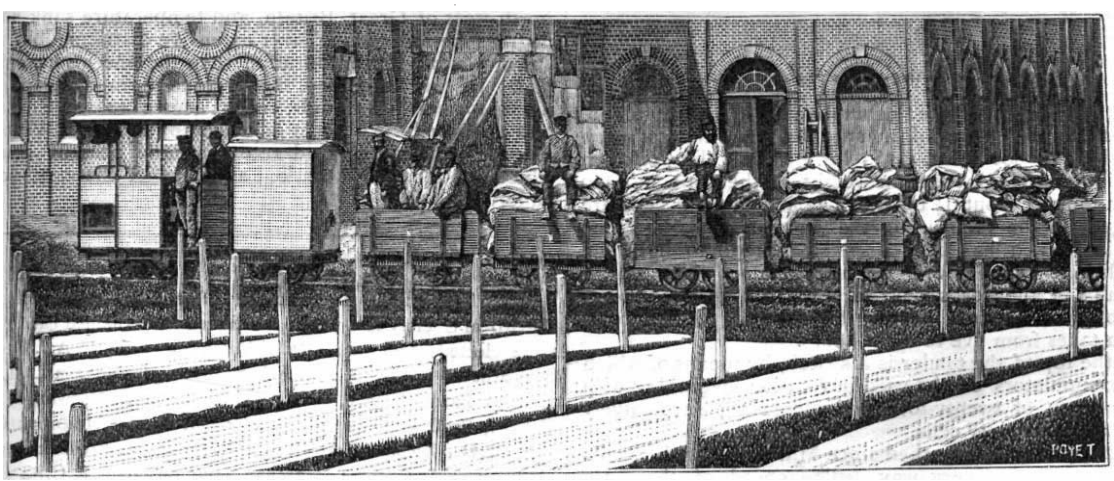

FIG. 4.—The return of the electric train from the bleaching ground.

The motor, or locomotive (Fig. 1) consists, as we have said, of a Siemens' dynamo capable of being reversed at will. The armature rotates very rapidly, the motion being reduced by a chain-gearing in the proportion of 1 to 9. A lever handle (see Figs. 1 and 5) controls the machine. As shown in Fig. 5, in a vertical position the brake is on, and no electrical action is taking place. By lowering the lever, contact is made, enabling the electric

current to flow. A "rheostat-chain," the invention of M. Reynier, who in 1881 applied a similar device to a sewing machine driven by electricity at the Paris Exposition, is thereby stretched. As its tension increases, there is better contact electrically between its links, and with this better contact the electric resistance diminishes; the flow of current and consequently the speed of the engine, is therefore increased. By moving the lever in one direction or the other, the speed of the train may therefore be varied at will. When the lever is put back to its position of rest, it not only breaks contact, but also puts on the brake. To reverse the motion of the train, there is a second lever, which shifts the brushes of the dynamo. A third lever sets the wheels of the dynamo in gearing either with the axle of the locomotive, or with the hauling machinery previously mentioned.

The tender (Fig. 2) attached to the locomotive holds the accumulators, which are of the type constructed by M. Reynier, consisting of two lead plates covered with red lead, and wrapped in felt or serge, rolled together in a spiral, placed in dilute acid in a stoneware jar. These cells are arranged (Fig. 2) in three tiers in baskets, each basket holding six cells. On each shelf are four baskets, except on the uppermost, which holds two only. The sixty accumulators weigh 500 kilogrammes (half a ton).

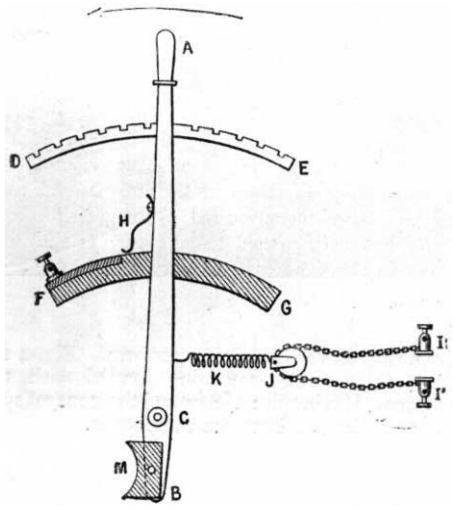

FIG. 5.—The starting-gear, with chain rheostat.

The total weight of the locomotive is less than a ton, that of the tender 700 kilos. (1543 lbs.), and that of each loaded truck 800 kilos. (1763 lbs.). With the workmen and six passengers, the total weight of the train is 6400 kilogrammes (about 6½ tons). The accumulator cells are charged at the factory by the current of a Gramme machine, which has been used since 1879 to light the establishment by eleven Reynier lamps. The power available in the works is 60-horse. Only 3 horse-power is, however, required during the charging of the cells, which takes from five to eight hours.

In the top of the tender is a switch, by means of which the accumulators can be used in rotation, beginning with a minimum of twenty-four, and increasing successively by sixes up to sixty cells.

This railway has worked since March last with results advantageous in every way. The speed of the train attains 12 kilometres (about 7½ miles) per hour; but in this special case, great speed is not desired. According to the information furnished by M. Dupuy, the train can work for three hours; being limited only by the charge that can be imparted to the accumulators.

This application of electricity to a purpose for which a steam-engine would be out of the question, is not only novel, but suggestive. We feel disposed to query how long it will be before that great section of the public of London who travel by the Metropolitan Railway, insist that their lungs and eyes have as much claim as the linen of M. Duchesne-Fournet to be protected from the disastrous presence of the smuts and scoriæ of the steam-engine.

THE WEATHER OF THE PAST WEEK

THE very disagreeable weather we have had these last few days deserves a passing notice. Strong persistent northerly winds for nearly a week have swept over the whole of the British islands. On Sunday and Monday a continuous north-easterly gale blew over Shetland and Orkney, completely interrupting all communication among these islands, accompanied with heavy rains, floods, and hailstorms; and at the same time much snow fell in the upland districts of the interior of North Britain, draping the mountains of Aberdeenshire and Perthshire in their winter covering of snow down nearly to their bases. On the other hand, in England and Scotland, much thunder and hail occurred towards the end of last week, and not a few lives were lost by the severity of the thunderstorms. These disagreeable and remarkable phenomena were attendants on an atmospheric depression signalled by the Meteorological Office on Thursday morning, last week, as about to advance over the more southern parts of these islands. The depression appeared in course, its centre following the line of the Cheviots; and its northern side being characterised by unwonted high pressures, it proceeded with singular leisureliness over the North Sea, and only reached Christiania by the morning of Monday. The slow onward rate of motion of this cyclone, the steep gradients formed on its north and north-west sides, and its southerly route across the North Sea readily explain the extent, strength, persistence, and disagreeably low temperature of the gale, and the unseasonable snowfalls which accompanied it. It is to such low depression-centres brooding over or slowly crossing the North Sea, that we owe our coldest summer weather; and it is a continued repetition of these in the critical months of June, July, and August that brings disaster to the farming interests. In the middle of June, 1869, a similar storm occurred when equally strong winds prevailed, when even more snow fell, particularly in the north-west of Great Britain, and temperature sank some degrees below freezing over extensive districts; but the storm was of shorter duration than the one we have just had. In this case, also, the cyclone formed steep gradients for northerly winds, and its centre crossed England and the North Sea, but it advanced over North-Western Europe at a more rapid rate than the present storm, which has formed so marked a feature of the weather of June, 1882.

NOTES

WE take the following from the *Times*:—At the meeting of the Royal Society last week, the fifteen undernamed candidates were elected Fellows:—Prof. Valentine Ball, M.A., George Stewardson Brady, M.D., F.L.S., George Buchanan, M.D., Charles Baron Clarke, M.A., F.L.S., Francis Darwin, M.A., F.L.S., Prof. William Dittmar, F.C.S., Walter Holbrook Gaskell, M.D., Richard Tetley Glazebrook, M.A., Frederic Ducane Godman, F.L.S., Prof. Jonathan Hutchinson, F.R.C.S., Prof. Archibald Liversidge, F.G.S., Prof. John C. Malet, M.A., William Davidson Niven, M.A., Robert Henry Inglis Palgrave, F.S.S., Walter Weldon, F.C.S.

IT is interesting to notice, that in connection with the vote of sympathy of the Common Council on the death of Garibaldi, the Lord Mayor stated that "on the death of the great philo-